Letters to the Editor

The Board of Editors will not hold itself responsible for opinions expressed in the letters, published in this section. The notes containing reports of new work communicated for this section should not contain many figures and should not exceed 500 words in length. The contributions must reach the Assistant Editor not later than the 15th of the second month preceding that of the issue in which the Letter is to appear. No proof will be sent to the authors.

1. POSSIBILITY OF POLARIZATION OF FREE ELECTRONS

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Powder of permanent magnet (coercive force, about 700 Oe) was oriented on a magnet substrate An electron beam (wavelength, about 0.03 A) was tunnelled through the magnet particles, as is shown in figure 1. A diffraction pattern here

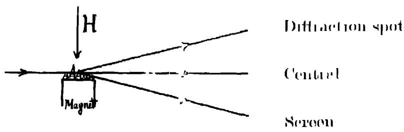

Fig 1. Arrangement of experi

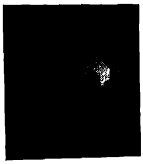

Fig 2, Diffraction pattern obtained from the magnet. Wavelength: 0 0286A, Camara length: 495 mm

Fig. 3. The central spot found in Fig. 2, 40 times enlarged optically. Splitting of electron beam is noticeable.

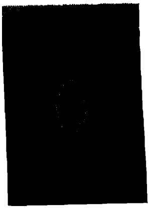

Fig. 4. The electron beam without touching the magnet There is no splitting here.

obtained is shown in figure 2. The central spot found in figure 2 was optically enlarged 40 times, as is seen in figure 3. It would be noticed in figure 3 that the electron beam is splitup after it has passed through the magnet body. The form of the electron beam, which did not touch the magnet, is shown in figure 4. In figure 4 there is no splitting of the beam. The author has tried to elucidate this splitting phenomenon as polarization of electrons.

There is a steep gradient of the magnetic field in the magnet. This gradient appears at the border between Weiss' magnetic domain and Bloch's magnetic wall. There is an interaction between the electron spins in the incidence and the magnetic field with the gradient. The geometric relation between the incident

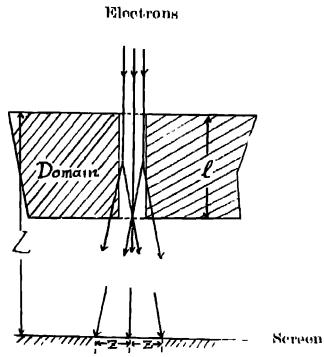

Fig. 5. Relation between the incident electrons and the inner magnetic field.

electrons and the inner field is illustrated in figure 5. In the arrangement of the experiment, the deflection of the electron beam is expressed by

$$\Delta Z = \frac{1}{2} B \left| \frac{\partial H}{\partial Z} \right| m \left(\frac{\lambda l}{h} \right)^2 \quad \cdots \quad (1)$$

where B is the magnetic moment of Bohr's magneton (0.93×10^{-20} erg/gauss), $\frac{\partial H}{\partial Z}$ is the gradient of the field, m is electron mass ($9.1 \times 10^{-28} g$), l is the path of the beam, λ is the wavelength of the beam (0.0286 Å), and h is Planck's constant (6.6×10^{-27} erg.sec).

In figure 5 we have a relation

$$\frac{\Delta Z}{Z} = \frac{l}{L} \quad \cdots \quad (2)$$

where Z means the distance between the splitup spots in figure 3. In figure 3 we can estimate $Z = 0.02$ cm. And if we assume $l = 10^{-3}$ cm, that is, the known linear dimension of Weiss' domain, then we obtain from Eq. (1) and Eq. (2)

$$\left| \frac{\partial H}{\partial Z} \right| = 4 \times 10^{13} \text{ gauss/cm} \quad \cdots \quad (3)$$

It is expected that this steep gradient of magnetic field is realised at the border between Weiss' domain and Bloch's wall. It is known that the thickness of Bloch's wall $\Delta\zeta$ is about 100 Å. If we assume

$$\frac{\partial H}{\partial Z} = \frac{\Delta H}{\Delta\zeta/2}$$

we have from Eq. (3)

$$\Delta H = 10^7 \quad \text{Gauss},$$

where ΔH means the strength of Weiss' field. This observed value coincides with the known strength of Weiss inner field.

Discussion here performed is not quantal, but it is classical. Quantum mechanics may treat this problem as result of exchange force between electron spins in the incidence and those in the magnet. The author has regarded here Weiss' molecular field as real. This thought is quite similar to the Bragg's thought that regards the interplanar spacings in crystal as real.

2 THERMOLUMINESCENCE SPECTRA OF LIF

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Lithium fluoride bombarded with 10 KV cathode rays at room temperature fluoresces weakly and the thermoluminescence glow is too weak for spectral analysis; however when exposed to cathode rays at 90°K it fluoresces blue and on prolonged irradiation the sample becomes red luminescent. On rapid heating, the coloured sample gives two glow peaks at approximately 140°K and 650°K. The first glow is intense but of short duration while the second is weak and persists for an appreciable time. The spectral distributions of these glows have been recorded by means of an automatic rapid scanning spectrophotometer by Dutta and Ghosh (1956). The spectra of the glows are found to be different. The band maximum at the first glow peak temperature is 435 mμ (frame No. 4) while that for the second is 597 mμ (frame No. 5). During the first thermoluminescence glow, in the temperature range 122°K to 140°K, there is an indication of a weak diffuse band on the shorter wave length side of the main band. The position of this band is indicated by an arrow in the spectral record. At about 128°K to 134°K another weak band appears on the longer wave length side, its position being marked by a double arrow in the record.

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